Hyperventilation in Cardiac Arrest:

A Systematic review & narrative synthesis

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Background

Out of Hospital Cardiac Arrest resuscitation occurs in around 30,000 cases across the United Kingdom each year [1]. Ambulance crews deliver advanced life support which includes chest compressions, ventilation, defibrillation, and drug administration During a cardiac arrest, patients are unable to perform gaseous exchange and so have a build up of carbon dioxide in their bloodstream which can lead to a severe respiratory acidosis; this can reduce the likelihood of sustaining a return of spontaneous circulation [2]. Ventilation is essential to ensure adequate oxygenation and carbon dioxide removal. Resuscitation Council UK outline that ventilations should be conducted at a rate of 10 min^{-1} [3]. However, ventilation with higher rates & volumes can decrease carbon dioxide concentrations more quicky [2].

Previous studies have shown hyperventilation can lead to barotrauma, hypotension, diminished pulmonary blood flow, and a reduced cardiac output [4].

The aim of this project is to describe the incidence, effects, and patient outcomes of hyperventilation by ambulance clinicians in out-of-hospital medical cardiac arrests.

Methodology

Systematic Review & Narrative Synthesis

Databases: CINAHL, MEDLINE, and Science Direct

Dates: 1st January 2000 - 27th April 2022

Keywords: Out of hospital | Prehospital | Ambulance | EMS Cardiac Arrest | Resuscitation | Hyperventilation | Ventilation Rate Return of Spontaneous Circulation | Survival | Discharge

Inclusion Criteria: English language | Primary Research | Human only Adult (18 years or older)

Exclusion Criteria: Traumatic cardiac arrest | Animal studies In-hospital or Simulated settings

A Critical Appraisal Skills Programme (CASP) checklist was followed to evaluate the quality of research papers included.

Findings & Recommendations

Articles retrieved from literature search (n= 326)

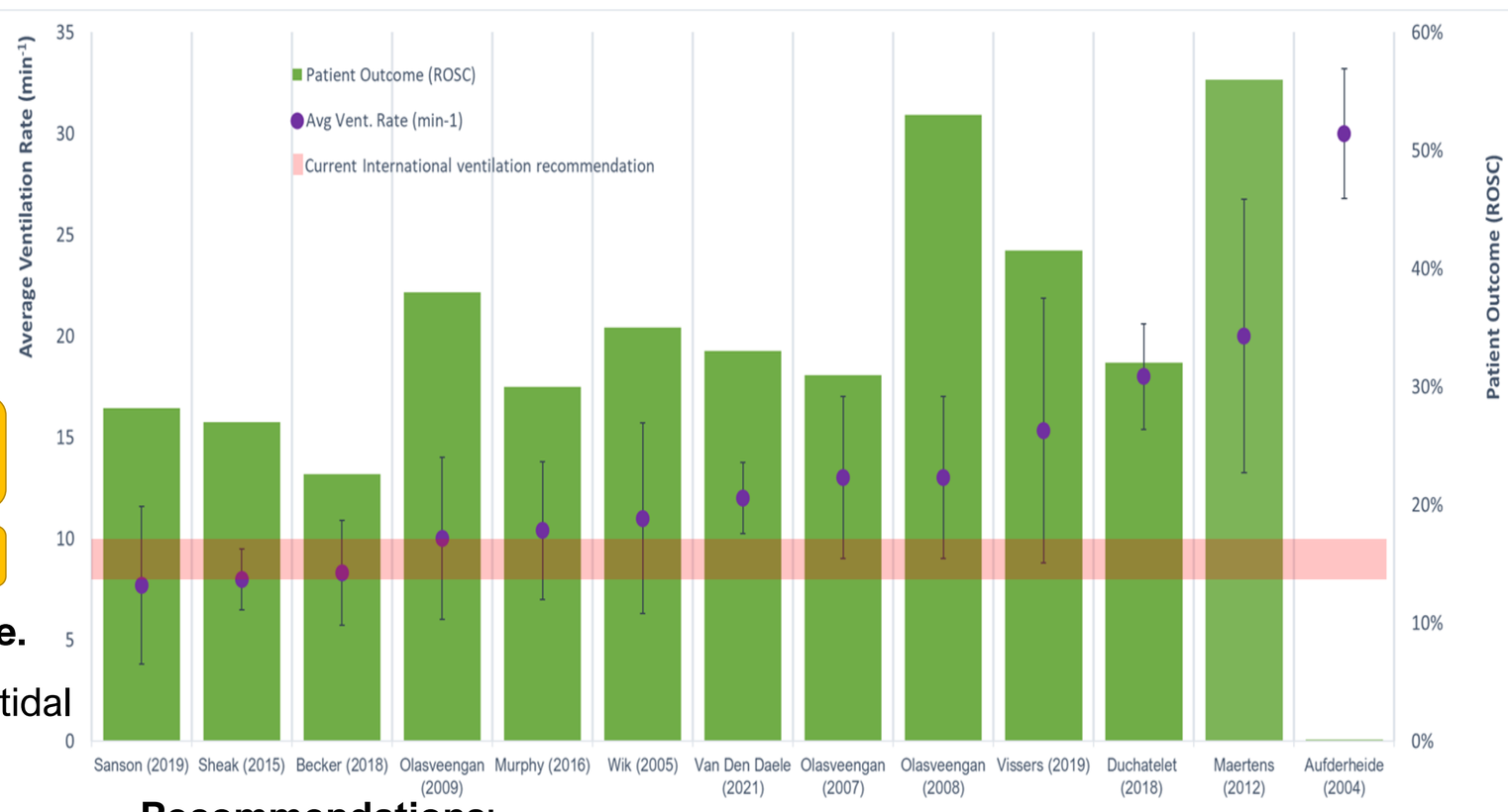
- **Science Direct** (n= 289)
- **MEDLINE** (n= 59)
- **CINAHL** (n= 14)

→ **Articles excluded after screening title & abstract** (n= 272)

Articles of which full text reviewed (n= 54)

→ **Articles excluded after screening full text** (n= 41)

Articles selected for review (n= 13)



Hyperventilation is still commonly reported in practice.

- Ventilations are consistently delivered at a rate & tidal volume higher than is international recommended.
- Ventilation rates do vary throughout a resuscitation due to differing chest compression to ventilation ratios (30:2 synchronous vs continuous).

Hyperventilation occurs due to :

- Stress | Poor leadership | Focus on other tasks (Intravenous/Intraosseous cannulation) [5] [6] .
- Short bursts of Hyperventilation can be purposeful & occur due to planned pauses in ventilation (before / after endotracheal intubation) [7] .
- Recent evidence challenges previous concerns over the negative effects of hyperventilation [8].
- **There are no discernible clinically significant differences between ventilation rates of ≤10min^{-1} vs >10min^{-1} and patient outcomes** [9].

Recommendations:

- Ventilation feedback devices should be used to guide clinicians in delivering ventilations at the recommended rate & tidal volume.
- Ambulance crews should receive regular education to ensure they are up-to-date on current guidelines & undertake high fidelity scenarios to simulate real-world stressors.
- **There are no human randomised control studies examining how ventilation rate, tidal volume or pressure effect patient outcomes and this warrants further research.**

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Full reference list available upon request